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ence of gold is impossible, so countless amounts of time and money have been squandered in agricultural experiment on land whose natural vegetation, if studied, would have directed other uses. One of the best applications of ecology is afforded by the work of Coville, on the culture of the blueberry, of which we are to learn something more to-day. The utilization of acid lands by the growth of crops that thrive in the presence of certain organic acids is a large conception and will doubtless prove to be one of the great utilitarian discoveries of our day.

I will not trespass on your time by indicating further practical applications of my chosen field, ecology. Others will suggest themselves, as will similar applications in various lines of botany, particularly in physiology. If we are to keep botany alive and abreast of the time, we who are in academic botanical departments must give more attention than formerly to the economic aspects of our subject. We must offer more courses in the practical phases of botany. In our research we must not avoid practical problems, but look for them, and we must emphasize the practical possibilities of our theoretical problems. Our sister science, zoology, which perhaps is in a more serious plight than we, gives evidence at this meeting of an attempt to meet the situation by choosing for its symposium the significant topic, "The Value of Zoology to Humanity." Above all we must treat the economic relations of our subject, not as an annex, a thing apart, a "sop to Cerberus," but as the vital and essential thing, the very kernel of it all. By pursuing such a course we shall keep in close relationship with our practical modern life, and we shall justify ourselves to our fellows. We shall then have ample opportunity to continue our researches along theoretical lines.

And one may never know how soon a purely academic study may come to be a factor of the first importance in the betterment of the human race.

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#### CONSERVE THE COLLECTOR

It is with considerable apprehension that I have observed an unmistakable decrease in the number of collectors during the past six or eight years. Matters of precision and accuracy in the field of ornithology are, I have no doubt, suffering as a consequence of this forsaking of the "shotgun method." Our faunistic literature to be of the highest scientific character must be based on the surest means of establishing the identification of species. The "skin record" is essential, and the availability of this is dependent upon the existence and activity of the collector.

The type of field observer who depends solely on long-range identification is becoming more and more prevalent. But the opera-glass student, even if experienced, can not be depended upon to take the place of the collector. Accuracy in identification of species and especially subspecies rests for final appeal upon the actual capture and comparison of specimens. Ornithology as a science is threatened, and it should not be allowed to lapse wholly into the status of a recreation or a hobby, to be indulged in only in a superficial way by amateurs or dilettantes.

It is to be doubted whether authoritative and expert systematic and field ornithologists can be developed through any other process than by personal collecting of adequate numbers of specimens in the field. The processes of hunting, and personal preparation of bird skins, bring a knowledge of the characters of birds, both in life and as pertaining to their structure and plumage, which can be secured in no other way.

The present tendency toward extermination of the collector bears obvious close relationship to the increasing number of extreme sentimentalist. The latter, beginning in a

good cause, now continue to urge stringency in state and federal laws beyond all reason. Those in authority "high up" ought to know better than to contribute to this stringency; but they, yielding to the pressure of the militant sentimentalists, are allowing laws and regulations to go through without giving apparently any thought to their duty toward the field naturalist, whose function is essential to the conduct of important phases of ornithological study.

Permits should be issued by both state and federal governments freely to applicants upon avowed sincerity of purpose. There should be no hesitation unless there be suspicion as to the honesty of the applicant. Limitations may be properly imposed, as, for instance, by excepting rare or disappearing species like the ivory-billed woodpecker or the Carolina parakeet. This is just as feasible as it is to forbid the sportsman to shoot rare or disappearing game species. Furthermore, the collector, by reason of his more expert knowledge, is far better able to discriminate between closely allied species, and, because of his appreciation of the facts upon which the principles of conservation are based, is more likely to abstain from killing the wholly protected species. As a rule, the birds which particularly interest the collector consist of small species, of wide distribution and large numbers. And the daily "bag-limit" of the collector, self-imposed because of the subsequent labor entailed, is small, seldom exceeding 20 birds all told, and, in my own experience, averaging 12.

Collecting, at best, will be indulged in by but comparatively few people, for it involves much more effort than hunting; the successful collector must possess a considerable equipment in the way of industry and artistic skill if he expects to reach recognized standing in the fraternity of collecting ornithologists; and at the outset he must possess the naturalist's gift or "bent" which is itself not common.

It can be rightly urged in this connection that the justification for collecting non-game birds is just as well grounded as for shooting or otherwise destroying *game* animals. Practically all small birds can better stand an

annual toll than most game birds. Citing a single species of non-game bird, the Audubon warbler, I believe that its numbers within the state of California at the beginning of the winter season exceed the combined numbers of all the species of game birds within the state at the beginning of the open season. Yet for the pursuit of game birds over one hundred and thirty thousand hunting licenses were issued last year here in California alone. In the same state, only one hundred permits for scientific collecting were allowed, or only one permit to collect non-game birds to 1,300 licenses to hunt game birds! Most of these permits were limited to two specimens of a kind, and in many cases they were given out grudgingly or under protest, as if the collector were seeking something beyond his rights to ask for, or even as if a question of morality were involved! This again is an attitude (on the part of *sportsmen*, which our State Game Commissioners all are!) hardly consistent, but evidently resulting from the wide-spread influence of the sentimentalist.

As compared with the value of the game bird shot, does not the bird killed for a specimen come much more nearly justifying its end? The game bird practically ends its career of usefulness when it falls before the gun. It has incited recreation and a certain amount of the esthetic in the way of admiration. Perhaps the latter obtains for a few minutes or hours after the death of the bird. But it soon goes to pot and that is the end of it.

With the bird hunted for a specimen, the collector is searching discriminatingly among many species and often among a great many individuals. He is observing many things beyond the mere object of the shot. In addition, full recreative value is being obtained as in the case of game (and this is generally urged now-a-days as *the* value of game—in its service, not as food, but as an object of pursuit and contemplation before killing). The value of a bird shot for a specimen does not end with its death, although it has served the other functions already. The collector prepares the bird with painstaking care, at

the same time acquiring added information, and installs it under safe conditions as an object of study and appreciation for all time. Instead of being merely eaten, it becomes a joy forever.

To my mind, there is no more practical reason for shooting a snipe for sport than for shooting a Savannah sparrow for a specimen.

My thesis is, not that hunting game for sport is unjustifiable, but that hunting both non-game and game birds and mammals for specimens is at least equally justifiable. The state and federal warden system should be revised so that the collector and the sportsman shall be treated on the same basis. That is all I am pleading for. The laws and those officers whose duty it is to interpret and enforce them should *allow* collecting and regulate it, just as is done in the case of hunting. Those in high official position should recognize the claims of the private collector as well as the claims of the sportsman. We are responsible one to another for looking after each other's interests. Those at the top should have a care for the privileges of their minority constituency, wherever such privileges be not in serious conflict with the interests of the majority.

A further instance of inconsistency is to be noted in the intemperance with which the reservation idea has been put into effect within the last few years. The whole scheme of game refuges, and the reservation of restricted areas for safe breeding grounds for birds, is a splendid one. Its adoption on a large scale is a thing worthy of the deepest satisfaction on the part of naturalists, economists and sentimentalists alike. But hasn't it gone beyond all reason when the Aleutian chain of islands is closed absolutely to the collector; when St. Lazaria Island, southeastern Alaska, which to my knowledge has been visited by collectors just three times in twenty years, is suddenly declared a bird reservation and the regulations so fixed as to completely bar the taking of birds or birds' eggs for bona fide scientific purposes! It seems to me vastly more reasonable, economically, to put colonies of sea-birds under warden control, and at the same time to

give the warden power of *allowing* moderate collecting and to see that such levy on the population is kept within the rate of productivity of the colony. It is exactly the same proposition as the gathering of mature timber from the forest reserve, or the shooting of moose and deer within certain safe numbers annually in Maine. A sea-bird colony, such as that on the Farallone Islands, would not suffer in the least if certain numbers of birds or eggs were gathered each year, totaling perhaps hundreds, just so these numbers were within the annual rate of increase. Such a course is absolutely the opposite of unlimited destruction, such as that waged by the plume-hunter. The latter violates the principles of conservation, which all men of science join with vigor in upholding.

Reasonable attention to several other factors, well known to collecting ornithologists, would far more than compensate for the toll taken by collectors. For instance, on the Farallone Islands the colonies of gulls are on the increase; the murre and cormorants are on the decrease, in spite of total protection, because of the piracy of the gulls. Many of the other birds on those islands would profit to a far greater degree if a considerable proportion of the gull population were eliminated. And this could be done easily through appropriate efforts on the part of a game warden at the beginning of the nesting season.

Collectors themselves probably fully compensate for the number of birds they destroy for specimens, in the incidental destruction by them of vermin. Collectors are practically the only people who can and do distinguish between the destructive and harmless hawks. The average collector can and does on all occasions destroy Cooper and Sharp-shinned Hawks, and in this way certainly makes up several times over for the small birds he shoots. Suggestive estimates could here be given as to the annual destruction wrought among both game and non-game birds by the few injurious species of hawks and owls. The predaceous blue-jays also receive the collector's attention.

It is true that collectors in the past have in

some instances behaved indifferently toward people who are sensitive to bird killing. This lack of sympathy on the part of the collector may be one factor that has brought him into disrepute. It is to be deplored. To control the thoughtless among collectors it is feasible to devise and enforce regulations, such as one to establish say a three-mile limit around all cities and even villages of a given minimum size. By similar action already taken in some states hunting is prohibited within specified distances of "public grounds." A system of local refuges and parks, where shooting for any purpose whatever would be prohibited, would certainly be approved by most collectors and would go far toward meeting the wishes of other lovers of living birds.

It should not be forgotten that the collecting ornithologist has furnished the bulk of the reliable data upon which our game laws are based, and upon which the economic value of our non-game birds has been established. Furthermore, the training involved in bird collecting can surely be given some credit in several cases of eminent men of science who are now valuable contributors to science in other fields. The making of natural-history collections is useful as a developmental factor, even if dropped after a few of the earlier years in a man's career. Collecting develops scientific capacity; it combines outdoor physical exercise with an appropriate proportion of mental effort, both enlivened with the zest of a most fascinating and at the same time widely suggestive line of enquiry.

As a rule, all collecting adds sooner or later to scientific knowledge, either directly through printed contributions from the collectors themselves, or through the subsequent study of the material by others, often after it has been acquired by some public institution. The ultimate fate of practically all private collections is the college or museum. Very few bird skins, for instance, are destroyed except through fire or other catastrophe. They live on and on, sources of added knowledge and instruction.

In conclusion let me urge that I consider judicious collecting absolutely indispensable

to serious ornithological research along certain important lines, namely, faunistics, systematics, migration, and food studies. There is still an enormous amount of investigation to be done along these lines. Right now progress is perceptibly retarded, because the field of ornithology is being avoided or deserted by the younger students. This desertion is often due to difficulties in the way of securing permits and to lack of encouragement on the part of older men. The legal attitude toward collecting should be revised so as to take in the needs and proper demands of the collector, as well as those of the sportsman.

JOSEPH GRINNELL  
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#### *THE SCIENTIFIC TREND IN SECONDARY SCHOOLS*

A MISCONCEPTION regarding the trend in secondary education seems to have been incorporated in recent educational opinion. From the first citation<sup>1</sup> below, there is quoted the following (p. 80) referring to Mr. Fisher's article.<sup>2</sup>

We note, therefore, the phenomenon of a decline in the ratio of students who elect science.

There can be no doubt that there has been a decline in the percentage of students electing physics, chemistry, physiography and physiology, as Mr. Fisher's graph shows, but that we are to conclude from these data that there is a decline in the sciences and an increase in the humanities is not so certain. It is quite possible that this decline in the enrolment in these subjects is explained by the shift of students with scientific interests to other subjects like botany, agriculture, domestic science, et cetera. Or it is conceivable that while the enrolment may decline, the length of time devoted to each subject is so in-

<sup>1</sup> Report of U. S. Commissioner of Education, 1913, Chap. V., "The Status of Secondary Education."

<sup>2</sup> "The Drift in Secondary Education," Willard J. Fisher, *SCIENCE*, November 1, 1912, N. S., Vol. XXXVI., No. 931.